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APPLICATION FOR UNITED STATES LETTERS PATENT

INVENTOR: William L. Walburn

TITLE: Shelf Lift System

ATTORNEY: A. James Richardson
BRINKS HOFER GILSON & LIONE
ONE INDIANA SQUARE, SUITE 1600
INDIANAPOLIS, INDIANA 46204
(317) 636-0886

BACKGROUND

[0001] 1. Technical Field — A shelf lift system for use in a cabinet structure employing a swingable linkage for moving a shelf between a lower position, which is situated within a cabinet and under a generally horizontal top surface of the cabinet, and an upper position, which is situated generally coplanar with the top surface, and for selectively maintaining the shelf in the lower and upper positions.

[0002] 2. Background Information — Many people prefer to maintain their residential kitchen counter tops as free from clutter as possible. Kitchen appliances that are not in current use are preferred to be stored out of sight. Such storage is easily accomplished for most light weight appliances. For heavier appliances, such as electric mixers and bread making machines, the movement between a cabinet storage position and the counter top can be awkward and difficult. Swinging shelf supports are known that can be used to move a shelf bearing such an appliance between a storage location within a cabinet under a counter top and a use position at substantially counter top level.

[0003] Carlson U.S. Patent 2,822,229 discloses such a swinging shelf support having of a pair of mechanisms, which are mirror images of each other, supporting the opposite sides of a shelf. Each mechanism includes a bracket having two pivot pins, affixed to a cabinet sidewall. One end of each of two arms is connected, respectively, to each of the pivot pins. The opposite ends of the two arms are pivotally connected to a plate that is affixed to the bottom of the shelf so that the two arms are maintained parallel to each other during movement of the shelf. A rib projects from the plate that limits the range of movement of the arms so that the shelf can move from a storage position within the cabinet and an upper position somewhat below the top surface of the cabinet. A tension spring extends between the bracket and a stud adjustably positioned on one of the two

arms to provide a biasing force assisting the upward movement of the shelf. During movement of the shelf toward the upper position, one of the arms displaces a strip spring shaped to include a projecting portion that can engage an upper surface of the arm. A single trigger is wired to the strip springs to cause disengagement of the projection portion so that the shelf can be lowered to the storage position. During movement of the shelf toward the storage position, the tension spring moves to an opposite side of one of the pivots so that the spring applies a retaining force to retain the shelf in storage.

[0004] While the basic design disclosed by Carlson is excellent, it does have some shortcomings. For example, the Carlson swinging shelf support is not capable of locating the shelf in the same plane as the top of the cabinet in which the support is mounted. The Carlson shelf support also includes a latch mechanism that is easily accidentally unlatched so that the shelf can suddenly descend from the raised position. The Carlson shelf support stop mechanism can abruptly halt downward movement of the shelf so that a shock or impact is delivered to any attachments between the bracket and the cabinet that can contribute to attachment failure. The Carlson shelf support spring adjustment can easily become disengaged so that the desired amount of biasing force is surprisingly no longer available. Some of the shortcomings of the Carlson design have been previously addressed in other prior art.

[0005] Some prior art swinging shelf supports, such as Hafele lift-up mechanism models 504.24.701 and 504.24.710, are capable of locating the shelf in the same plane as the top of the cabinet in which the support is mounted, but still share some of the other shortcomings of the Carlson design. Thus, there remains a need for a swinging shelf support system that eliminates all of the shortcomings of the Carlson design.

SUMMARY OF THE INVENTION

[0006] A swinging shelf support system of the present invention includes a pair of shelf lift mechanisms that are mirror images of each other and intended to support opposite sides of a shelf for movement with respect to a cabinet having a generally planar counter top. Each shelf lift mechanism has a support bracket with a first and a second pivot coupled to the bracket. A first bar and a second bar are respectively coupled to the first and second pivots for movement relative to the support bracket. A shelf support is coupled to the first and second bars for movement with the bars relative to the bracket between an upper position wherein the shelf is essentially coplanar with the adjacent counter top and a lower position fully within the cabinet below the counter top. A biasing spring provides a balancing force to offset the weight of the shelf and any appliance or other mass situated on the shelf so that movement of the shelf between the two positions is easily accomplished.

[0007] One feature of a shelf lift system of the present invention is a cushion fixed to the support bracket at a position designed to intercept a stop contact portion of one of the first and second bars when the shelf support moves to the lower position. The cushion is preferably made of rubber with a durometer of between about 40 and 70 Shore A. The cushion is preferably located between the first and second pivots on the support bracket so that an extension of one of the bars can constitute the stop contact portion.

[0008] Another feature of a shelf lift system of the present invention is a tension adjustment member that is coupled to one end of the biasing spring and pivotally connected to one of the first and second bars. The adjustment member includes a handle facilitating adjustment of the biasing force and a plurality of openings designed to receive a fastener to securely position the adjustment member at a suitable position to apply a selected

biasing force to compensate for the various appliances or other goods on the shelf.

[0009] Yet another feature of a shelf lift system of the present invention is a latch coupled to the shelf support and a latch pin coupled to one of the first and second bars at a position that permits engagement of the latch pin and latch when the shelf support is in the upper position. A latch release lever including a handle is coupled to the latch, each handle being independent from the corresponding latch release for the coordinate shelf lift on the opposite side of the shelf. A biasing spring is coupled to the latch to bias the latch toward engagement with the latch pin so that accidental release of either latch is rendered unlikely.

[0010] Additional features of a shelf lift system of the present invention will become apparent from a consideration of the following description of a preferred embodiment shown in the accompanying drawings that illustrate the best mode of carrying out the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Figure 1 is a perspective view, partly broken away, showing a shelf lift system of the present invention with the shelf in a lower position.

[0012] Figure 2 is a perspective view showing the shelf lift of Figure 1 with the shelf in an upper position, the door being omitted for clarity.

[0013] Figure 3 is an elevation view of a first side of a shelf lift mechanism of the present invention.

[0014] Figure 4 is an elevation view of a second side of the shelf lift mechanism shown in Figure 3.

[0015] Figure 5 is a detail view of a support bracket including an absorbing cushion and the biasing adjustment plate.

[0016] Figure 6 is a detail view of the shelf support bracket showing the latch mechanism.

[0017] Figure 7 is a detail view of the support bracket shown in Figure 5 with the swinging arms moved to the lower position.

[0018] Figure 8 is an elevation view of a biasing adjustment plate.

[0019] Figure 9 is a detail view of the opposite side of the shelf support bracket shown in Figure 6.

[0020] Figure 10 is a perspective view of the latch shown in Figures 6 and 9.

[0021] Figure 11 is a perspective view of a shelf lift mechanism of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] A swinging shelf support system 10 of the present invention is shown in Figures 1 and 2. The shelf support system 10 includes a pair of shelf lifts mechanisms 12, which are generally mirror images of each other, intended to support opposite sides 14 of a shelf 16 for movement with respect to a cabinet 18 having a generally planar counter top 20 including top surface 21. The cabinet 18 can include a base 22 having a floor shelf 24, a back wall 26, and side walls 28 and 30. A perimeter frame 32 defines an opening opposite the back wall 26. A door 34 can be coupled to the perimeter frame 32 with hinges 36 to control access to the interior of the cabinet 18. The counter top 20 can be secured to upper ends of the back wall 26, the side walls 28 and 30, and the perimeter frame 32. The counter top can cover merely the space between the side walls 28 and 30, but may also extend laterally to cover additional cabinets, not shown.

[0023] The shelf 16 can include a bottom surface 38 and a top surface 40. The shelf 16 can also include a back margin 42 and front margin 44, which may include a portion projecting above the top surface 40 of shelf 16. The shelf 16 must be laterally narrower than the opening defined by the perimeter frame 32 to permit movement of the shelf 16 out of and into the cabinet 18. With the door 34 open, the shelf 16 can be

moved with the aid of swinging shelf support system 10 of the present invention, between a lower position wherein the shelf 16 is wholly contained within the cabinet 18, shown in Figure 1, and an upper position wherein the top surface 40 of the shelf 16 is substantially coplanar with the top surface 21 of the counter top 20, shown in Figure 2. Each shelf lift mechanism 12 includes a support bracket 46, which is secured to the cabinet 18. The support bracket 46 can be secured to a side wall 28 or 30 of the cabinet 18. Each support bracket 46 includes a forward pivot 48 and a rearward pivot 50. A forward bar 52 is coupled to the forward pivot 48 and a rearward bar 54 is coupled to the rearward pivot 50. Each mechanism 12 of the shelf support system 10 of the present invention also includes a shelf support 56 that can be secured to the bottom surface 38 of the shelf 16. The shelf support 56 also includes a forward pivot 58 and a rearward pivot 60. The forward bar 52 is coupled to the forward pivot 58 on the shelf support 56, and the rearward bar 54 is coupled to the rearward pivot 60 as shown in Figures 2, 4, and 6. The forward and rearward bars 52 and 54 simultaneously swing between the lower and upper positions, shown in Figures 1 and 2, respectively, while maintaining the top surface 40 of the shelf 16 generally parallel to the top surface 21 of counter top 20.

[0024] Figures 3 through 11 show additional details of a shelf lift mechanism 12 of the present invention. In Figures 3 through 5 and 7, it will be seen that the support bracket 46 can include a generally planar central portion 62 separating forward edge flange 64 and rearward edge flange 66, which may be located in a plane other than the central portion 62 as shown in Figure 11. The flanges 64 and 66 and connected to the central portion 62 by webs 63. The flanges 64 and 66 can include any number of openings 68 to receive fasteners for fastening the support bracket 46 to the cabinet 16. The forward pivot 48 and the rearward pivot 50 can be located

in the central portion 62. The forward pivot 48 can be positioned near an upper edge 70 of the central portion 62 while the rearward pivot 50 can be positioned near a lower edge 72. A bias anchor 74 can be provided on the central portion 62 of the support bracket 46. The bias anchor 74 can project from the central portion 62 in the same general direction as the webs 63, toward the sidewall 28 of the cabinet 18. A cushion support 76 can be fixed to the central portion 62 of the support bracket 46 roughly between the forward pivot 48 and the rearward pivot 50. A cushion 78 can be fixed to the cushion support 76 so that an end 77 protrudes from the cushion support 76.

[0025] The forward bar 52 includes a first end 80 and a second end 82. The first end 80 of the forward bar 52 can be coupled to the forward pivot 48 on the central portion 46 of the support bracket 46. The second end 82 of the forward bar 52 can be coupled to the pivot 58 on the shelf support 56. The rearward bar 54 also includes a first end 84 and a second end 86. The second end 86 can be coupled to the pivot 60 on the shelf support 56. The rearward bar 54 can also include an intermediate pivot coupling point 88 spaced from the first end 84. The intermediate pivot coupling point 88 on the rearward bar 54 can be coupled to the rearward pivot 50. A portion 90 of the rearward bar located between the intermediate pivot coupling point 88 and the first end 84 can come into contact with the protruding end 77 of cushion 78 when the shelf 16 is in the lower position as shown in Figures 1 and 7.

[0026] The rearward bar 54 can also include a tension adjustment support 92 located between the second end 86 and the intermediate pivot coupling point 88. A tension adjustment member 94, which can include a handle 96 to facilitate adjustment of the position of member 94, can be pivotally coupled to the tension adjustment support 92. The tension adjustment member 94 includes a bias post 98. A biasing member 100 in

the form of a tension spring can be extended between the bias post 98 on the tension adjustment member 94 and the bias anchor 74 on the central portion 62 of the support bracket 46. As shown particularly in Figure 8, the tension adjustment member 94 can include an opening 102 for pivotally coupling the adjustment member 94 to the tension adjustment support 92 on the rearward bar 54. The tension adjustment member 94 can also include a plurality of openings 104 that can be selectively engaged by a fastener 106. The selection and engagement of one of the plurality of openings 104 by a fastener 106 creates an initial bias value for the tension applied by the biasing member 100.

[0027] Figures 9-11 show that shelf support 56 can include a lateral flange 108. A plurality of openings 110 are provided in the lateral flange 108 to receive any number of fasteners for fastening the flange to the bottom surface 38 of the shelf 16. The shelf support 56 also includes a forward pivot 58 and a rearward pivot 60. The second end 82 of the forward bar 52 is coupled to the forward pivot 58 on the shelf support 56, and the second end 86 of the rearward bar 54 is coupled to the rearward pivot 60 as shown in Figure 6. When the shelf support 56 is located in the upper position as shown in Figures 3 and 4, the biasing member 100 is situated above and in front of rearward pivot 50, and generally aligned with the cushion support 76. When the shelf support 56 is lowered to the lower position as shown in Figures 1 and 7, the biasing member 100 moves to a position located behind the rearward pivot 50. A latching mechanism 112 can be supported on the shelf support 56 for locking the shelf support 56 in the upper position shown in Figure 2.

[0028] The latching mechanism 112 can include a latch pin 114 fixed to the forward bar 52 at a position spaced from the second end 82, yet overlapping the shelf support 56 when located in the upper position. A latch 116 can be coupled to the shelf support 56 by a pivot pin 118. The

latch 116 is shown in greater detail in Figure 10 to include a latch body 120 that can have a concave edge 122 sized to engage the latch pin 114 as shown in phantom in Figure 9. An inclined edge 124 can be positioned above and separated from the concave edge by a nose portion 126. The body 120 can also have an opening 128 adjacent one end of the body to accept the pivot pin 118 and a lateral protrusion 130 positioned at the opposite end of the body 120. A latch bias engaging pin 132 extends laterally from one surface of the body 120 and can protrude through an opening 57 in the shelf support 56 shown in Figure 9. A latch bias spring 134 can extend between pin 132 on the latch body 120 and a latch spring anchor pin 136 fixed to the shelf support 56. The lateral protrusion 130 can also protrude through an opening 55 in the shelf support 56 as shown in Figure 6. The lateral protrusion 130 engages slot 138 in latch release rod 140. The latch release rod can include slots 142, which may receive anchor pins 144 fixed to the shelf support 56 that allow for a sliding movement of the latch release rod 140 with respect to the shelf support 56. The latch release rod 140 can include a handle portion 146 such as that shown in Figure 11.

[0029] In operation, the shelf lift system 10 of the present invention retains the shelf 16 within the cabinet 18 by virtue of the over-center relationship of the biasing spring 100 with respect to rearward pivot 50. When the load to be supported on shelf 16 is lighter, the force required to be applied by the biasing spring 100 need not be as great as when the load to be supported is heavier. The force applied by the spring 100 to retain the shelf 16 in the position shown in Figure 1 can be adjusted by removing fastener 106, pivoting the adjustment member 94 around adjustment support 92 to a new location, and reinserting fastener 106 into one of the plurality of openings 104. To move the shelf 16 from the lower position within the cabinet 18 to the upper position wherein the shelf 16 is

substantiality coplanar with the counter top 20, one merely needs to apply sufficient outward force on the front margin 44 of the shelf 16 to pivot the bars 52 and 54 to the point that the biasing spring 100 is displaced to a point in front of rearward pivot 50, where upon the biasing spring 100 assists in the outward and upward displacement of the shelf 16.

[0030] As the shelf 16 approaches the upper position from the lower position, the latch pin 114 carried by front bar 52 contacts the upper surface 124 of the latch 116. Continued upward displacement of the shelf 16 and shelf support 56 causes the latch pin 114 to pivotally displace the latch 116 to the point where the nose 126 passes the latch pin 114. The latch bias spring 134 then causes a rotational displacement of the latch 116 around pivot 118 until concave edge 122 comes into contact with the latch pin 114 effectively locking shelf 16 in the upper position shown in Figure 2. Since a shelf lift system 10 of the present invention includes a pair of shelf lifts mechanisms 12, which are generally mirror images of each other, typically there are engaging latches and latch pins supporting both sides 14 of shelf 16. In the event that only one of the latches and latch pins engage, the shelf is still inhibited from downward displacement by the biasing force of biasing spring 100, and prohibited from downward displacement by the single engaged latch 116. The double engagement of both latches 116 and latch pins 114 can be viewed as a safety measure rather than one of necessity for maintaining the shelf 16 in the upper position.

[0031] This safety measure is particularly evident when considering the steps necessary to lower the shelf 16 from the upper position. Assuming that both latches 116 are engaged, an outward force must be applied to the handles 146 of the latch release rods 140 on both sides of the shelf 16. The force necessary for release is determined by the strength of the latch bias springs 134 and any incidental frictional forces. Any accidental pull on

only one of the handles 146 is unlikely to release both latches 116. When both latches 116 are released, the shelf 16, together with what ever load has been applied to the shelf, should descend slowly against the biasing force applied by biasing spring 100. A small downward and inward force may be required to complete the movement of the shelf 16 to the point where the biasing spring 100 passes the rearward pivot 50. Once past the rearward pivot 50, the biasing spring 100 acts to continue displacement of the shelf 16 into the cabinet 18 until the stop contact portion 90 of bar 54 contacts the end 77 of cushion 78. The cushion 78 deforms in response to the contact by the bar 54 to absorb the kinetic energy of the rearwardly moving shelf 16 so that any shock to the cabinet 18 or rebound of the shelf 16 in minimized.

[0032] It is intended that the foregoing description be regarded as illustrative rather than limiting, and that the following claims, including all equivalents, define the spirit and scope of this invention.